well, and will have very little trouble from the treatment.

To admit this much is not to excuse the anti-vivisectionists; indeed, it makes their behaviour look blacker than ever. For example, they discover a case of pneumonia, coming on after the treatment, and forthwith they proclaim it as "septic pneumonia from inoculation." Or they discover a case of a bad arm after ordinary vaccination; this may have been the man's own fault; later he was discharged from the Army for a cause which had nothing to do with his arm. And forthwith they declare that the man's health was so impaired by the protective treatment against typhoid that he had to leave the Army. "Proved to be useless and dangerous"—that is the opinion—if we can call it an opinion—of these people. They are a very small handful of people, in proportion to the general public; but they are trying hard to prevent our men from being protected.

It is probable that some of them are incapable of clear thought on the subject. We may wonder what they will make of the statement just issued from the War Office, and published in Sir Frederick Treves's letter in the *Times* of January 26. Up to date, among our men abroad there have been thirty-five deaths from typhoid. Of these thirty-five men, thirty-four were not protected; it was two years or more since they had received any sort of protective treatment. Among our protected men there has been only one death, and this patient had only had a single dose of the protective treatment, instead of two doses as directed.

What will the anti-vivisectionists say to this? Which way will they look? Will they say that we do not know the proportion of non-protected to protected men throughout the Expeditionary Force? But we do know what strenuous and incessant efforts are made to avoid the sending out of non-protected men. Surely it is a safe guess that the great majority of the Expeditionary Force are protected. Nature leaves these alone; she picks out the non-protected. Two men shall be sleeping in one tent, fighting in one trench; the one shall be taken, and the other left. The anti-vivisectionists know that, lots of them; and we come back to Newman's saying, "Perhaps it is wrong to compare sin with sin, but I declare to you, the more I think of it, the more intimately does this *Prejudice* seem to me to corrupt the soul, even beyond those sins which are commonly called most deadly."

MR. F. W. RUDLER.

As announced with regret last week, Mr. F. W. Rudler died on January 23 at his residence, Tatsfield, Surrey, after a brief illness, in his 75th year. He will be lamented by a large number of scientific friends, who have known him not only as the genial curator of the Museum of Practical Geology, but also as a prominent member of many scientific societies and at the meetings of the British Association.

It was some fifty-five years ago that Mr. Rudler was appointed Assistant Curator of the Jermyn Street Museum. He rapidly made his mark as a mineralogist, and became more and more in request as a specialist in that department. In 1876 he was appointed lecturer in natural science at the University College of Wales at Aberystwyth; but in 1879 was recalled to succeed Mr. Trenham Reeks, as Registrar of the Royal School of Mines and Curator of the Museum of Practical Geology, which post he held until his retirement in 1902, when the high appreciation of his services was marked by the bestowal upon him, by King Edward, of the Imperial Service Order.

Beyond his official duties, Mr. Rudler was a busy worker and a voluminous writer. He was at different times president of the Anthropological Institute, also of the Geologists' Association and of the Essex Field Club. He was for years an active member of council of the Geological Society, and was awarded the Lyell Medal of the Society in 1903.

Mr. Rudler's popularity as a science lecturer caused him to be much sought after. His writings were largely in connection with technical works, such as "Ure's Dictionary of Arts and Manufactures," "Thorpe's Dictionary of Applied Chemistry," "Muir's Dictionary of Chemistry," the "Encyclopædia Britannica," etc. Articles and reviews flowed from his pen in a continuous stream for years, and he will long be remembered as a man of wide scientific attainments and high literary ability.

NOTES.

THE committee of users of dyes appointed to confer with the Board of Trade as to a national dye scheme has come to a unanimous decision in favour of the adoption of a scheme which differs in certain important respects from those of the scheme previously made public. The proposal is to form a company with an initial share capital of 2,000,000*l.*, of which 1,000,000*l.* will be issued in the first instance. The Government will make to the company a loan for twenty-five years corresponding to the amount of share capital subscribed up to a total of 1,000,000*l.*, and a smaller proportion beyond that total. The Government advance will bear interest at 4 per cent. per annum, payable only out of net profits, the interest to be cumulative only after the first five years. In addition, and with the desire of promoting research, the Government has undertaken for a period of ten years to make a grant to the company for the purposes of experimental and laboratory work up to an amount not exceeding in the aggregate 100,000*l.* The modified scheme has been received with more approval from users of dyes in Leeds and the district than the original scheme, and the feeling appears to be general that it will meet with a considerable measure of success. The grant for scientific research in connection with the manufacture of dyes is a particularly satisfactory provision of the new scheme.

The relation between science and industry in this country has been the subject of a number of letters and articles in the daily papers recently, but the real difficulties of the situation from the scientific point of view have not usually been explained. Prof. J. F. Thorpe, however, in the *Times* of February 2, states clearly what the national needs are in this matter. It is often supposed that when business men decide what substance they wish to obtain all the chemist has to do is to look up the details of the preparation of the substance in the German patent literature and then to proceed in the same manner as a chef would do if he wished to make some new kind of pudding. This point of view is due to an entire lack of understanding on the part of the non-scientific person of the principles underlying scientific processes. Essential details are carefully excluded from patent specifications, and it is safe to say that an independent worker would, in most cases, have to devote some months to experiments on the scientific scale before he could find the correct conditions for applying a process to the commercial scale. Prof. Thorpe pertinently remarks in concluding his letter:—"Do the Government imagine, therefore, that any works research laboratory is going to solve these problems and adapt them to commercial conditions within any reasonable period of time? If they do, thev are greatly mistaken. The object *can* be achieved, but only by enlisting the services of every trained organic chemist in this country. The Government must organise the knowledge and skill which is, from the industrial point of view, now wasting in our universities, university colleges, and technical schools; moreover, it is only by a scheme such as this that the nation will be able to pick out those men who are fitted by temperament to be directors of commercial processes."

It is a fine instance of taking things quietly that the Rev. W. M. L. Evans, rector of Saxby, in North Lancashire, should write to the *Times* of January 28 pointing out that the pheasants of the parish were very much excited on the morning of Sunday, January 24, when the naval engagement was in progress. From the way in which the pheasants were "all over the place with their fuss," the clerk of Saxby inferred "there be rare goings on in the North Sea the morn." Without precise records of hours, observations of this sort are not of much scientific value, but they suggest that those who have time and are familiar with the normal ways of birds should keep an eye on similar occurrences. It is well known that birds have a quick and discriminating sense of hearing, and there is nothing essentially improbable in supposing that the Saxby pheasants heard news which failed to reach the parishioners. Several correspondents describe in the *Times* of February 1 observations in support of Mr. Evans's account of the disturbance of pheasants by the North Sea cannonade; and instances are given of similar effects produced on the birds upon other occasions and in other places, including New Zealand, by distant explosions and earthquakes. It may be premature to believe in the extraordinary sensitiveness of the Saxby pheasants, and the case is not strengthened by a reference to the geese of the capitol, but critical and comparative observations on the sense of hearing in birds would be interesting. It is certain, said Bewick, "that nothing can stir in the night, nor the least or most distant noise be made, but the geese are roused, and immediately begin to hold their cackling converse." It should also be remembered that noises inaudible in one zone are sometimes perceived in another more distant.

In *Popular Astronomy* Prof. E. C. Pickering quotes some interesting letters from Profs. Backlund, of Pulkovo, and Schwarzschild, of Potsdam, with reference to astronomers and the war. None of the Pulkovo astronomers have been called to serve, but Prof. Backlund's son is in the Russian ranks, and of French astronomers, M. Croze, astrophysicist of the Paris Observatory, has been summoned, as well as the son of the director, M. Baillaud, who has six sons and sons-in-law in the war. On the German side, many young astronomers are in the field. Dr. Zurhellen and Dr. Kühl, who were with the eclipse expedition, have been interned in Russia; Dr. Münch, of Potsdam, is wounded and a prisoner in France. Prof. Schwarzschild writes that he is himself at Namur, conducting a military meteorological station in the interest of the German aeroplanes and dirigibles. Prof. Bauschinger, director of the Strasburg Observatory, is a temporary terminus commander in that city The *Astronomische Nachrichten* contains announcements of the deaths in the ranks of Dr. J. Liebmann, astronomer at the Berlin Observatory; also of Dr. Adam Massinger, of the Heidelberg Observatory, his death cutting short an elaborate investigation of the nebulæ photographed at the observatory. Dr. Martin Matzdorff, assistant at the Strasburg Observatory, a young man of great promise, was killed at Ypres in November.

Doubtless further particulars will be available when the American mail brings over last week's technical papers, but in the meantime it is probable that the long-distance telephone record, namely, conversations between Washington and San Francisco, both *via* New York and Boston, is no more than the natural outcome of the gradual extension of telephone lines with "loading coils" on the Heaviside-Pupin principle. That the feat has been accomplished by means of a new device just invented by Prof. Pupin, as one might gather from the telegram sent by the New York correspondent of the *Times* last week, seems unlikely. The "loaded" telephone line from New York to Denver (a distance of 2000 miles) has been in use for some little time, and the extension of this to San Francisco (making a distance of 3000 miles) is known to have been under construction. Apparently, as an experiment, a considerable *détour* was made, no doubt over other "loaded" lines, and Jekyll Island (Georgia) was included in the circuit; the total distance telephoned over is given as 5000 miles—certainly a record. It is interesting to note that Prof. Graham Bell, the inventor of the telephone, and now more than eighty years old, was able to converse over the line. The *Times* correspondent regards the event as foreshadowing the day when New York can talk with London, but this is somewhat premature. Although this distance is far less than 5000 miles, yet the problem is a much harder one owing to the enormously greater electrostatic capacity of a cable as compared with a land-line. There is much in Prof. Fleming's prediction that telephony between England and America, when it comes, will first be by "wireless."

SOME anxiety has been felt as to the fate of M. le Chanoine Henri de Dorlodot, Professor of Geology at the University of Louvain, concerning whom his colleagues in this country had been unable to obtain information. They will be glad to learn that he is at Louvain, in excellent health, and that his house and museums are absolutely untouched.

A PUBLIC lecture on the present position of the atomic theory was delivered by Prof. J. W. Nicholson at King's College on January 21. The lecturer reviewed the work of Faraday on electrolytic conduction, the origin of our first perception of the ultimate charge *e*, and proceeded to a historical sketch of the evolution of modern ideas of the atom as a purely electrical structure. An account was then given of very modern work in connection with radio-activity, X-rays, and emission spectra, concluding with the probable structure and number of electrons present in atoms of the simpler elements, and the possibilities of a celestial evolution of the elements which are now disintegrating.

SINCE January 14 several earthquakes have been felt in Italy and elsewhere. Two after-shocks of the Avezzano earthquake were felt in Rome on January 18. During the night of January 18–19, three earthquakes occurred in the province of Cosenza (Calabria), some buildings in the village of Luzzi being slightly damaged. According to the *Times*, various observatories in Italy recorded an earthquake at 2.15 a.m. (1.15 a.m., G.M.T.) on January 27, which lasted ten minutes, and was more violent than that which destroyed Avezzano. As no further account has been published, this earthquake would appear to be the same as that registered in British observatories at about the same time. The West Bromwich seismogram suggests an origin distant about 1500 miles, probably in Turkey or Greece.

IN the issue of NATURE for July 10, 1913, (vol. xci., p. 483) particulars were given of the allocation by the Mansion House Committee of the Captain Scott Fund. It will be remembered that the allocation fell under three main headings: the provision for relatives, for the publication of the scientific results, and for memorials. In connection with the last-mentioned object it is now announced that the committee has entrusted the execution of a monument to Mr. Albert H. Hodge. The monument and the pedestal are to cost 750*l*. The architectural portion is to be of grey granite. A site has been selected by the committee facing the Thames in the grounds of Greenwich Hospital. A bronze memorial tablet to be placed in St. Paul's Cathedral is being executed by Mr. S. Nicholson Babb.

THE director of the Commercial Intelligence Branch of the Board of Trade, 73 Basinghall Street, London, E.C., has kindly sent us further information upon the subject of the trade in birds' feathers between India and Germany, referred to in a note in NATURE of January 28 (p. 596). He reminds us that the "Report from the Select Committee of the House of Lords on the Importation of Plumage Prohibition Bill (H.L.) 1908," contains much information of interest upon the subject. The Select Committee reported that "it appears clearly from the evidence that the enactments of British Colonies and certain foreign countries, which provide a close season for wild birds, and of India, which prohibits their export, are to a considerable extent ineffective, partly on account of the open market in this and other countries. Mr. Todhunter, who attended on behalf of the India Office, showed the difficulties of preventing illicit exportation." The Report may be purchased, either directly or through any bookseller, from Messrs. Wyman and Sons, Ltd., Fetter Lane, London, E.C., the reference number being H.L. 137, and the price 6*d*. (ex-postage), or it may be consulted at the office of the Commercial Intelligence Branch of the Board of Trade.

IN the *Cairo Scientific Journal* for August, 1914, Mr. W. H. Harding King has collected a good budget of folk beliefs and songs from the western oases. The magical element is prominent in the beliefs of these people. When a child is born grain and salt are trundled about in a sieve to ensure the child against want; the pestle and mortar are beaten to make sure that he may not be frightened by any noise when he grows up; seeds are thrown about in the village as a charm to enable him to travel to any part of the world that he pleases, and the sieve is rolled about so that when he grows up he may run about quickly. When his finger nails grow long they are cut, and the ends of his fingers are dipped into newly ground flour to prevent them from growing again, and as the natives consider it unlucky to open a pair of scissors before the child's face, his nails are either cut behind his back, or bitten off by his parents. To protect trees from the Evil Eye and to ensure a good crop, a bone or the skull of an animal, or a piece of manure or a small doll-like figure are hung on the branches. Natives refresh themselves by stuffing the small pungent onions of the oases into their nostrils; onions which over night have been kept under the pillow are hung with the barley to bring refreshment to the family until the next season.

THE Herbert Spencer Lecture at Oxford last year was delivered on November 18, 1914, by the Hon. Bertrand Russell, on "Scientific Method in Philosophy," and has just been issued in pamphlet form by the Clarendon Press (1*s*. 6*d*. net). Mr. Russell's thesis is that it is from science rather than from ethics or religion that philosophy should draw its inspiration. In fact, scientific philosophy aims only at understanding the world and not directly at any other improvement of human life; and thus it cannot take account of ethical notions without being turned aside from that submission to fact which is the essence of the scientific temper. It is piecemeal and tentative like other sciences, and not like philosophy has been hitherto, where each philosopher had to begin the work again from the beginning. For further elaboration of the views on logic as the essence of philosophy and the foundations of physics, Mr. Russell refers to his book on "Our Knowledge of the External World" (Chicago and London: Open Court Publishing Co., 1914); reviewed in NATURE of November 12, 1914 (vol. xciv., p. 278). The adoption of scientific method in philosophy compels us to abandon the hope of solving many of the more ambitious and humanly interesting problems of traditional philosophy; but what it does solve it solves with great precision.

IN the *Revue Scientifique,* No. 1, 1915, an interesting summary is given by Dr. Landrieu of the use of tincture of iodine for the antiseptic treatment of wounds on the battlefield. Descriptions are given of several ingenious tubes by means of which the iodine may be carried and applied. Dr. Maumus, in the same journal, also gives an account of tetanus among the wounded.

WE have received the annual report of Livingstone College for 1913–14. This was the last session of the principalship of Dr. Harford, who has worked untiringly for twenty-one years. During this period 548 students have passed through the college, and have gone forth to all parts of the world. The college was instituted in order to give some medical education to missionaries, and it has well fulfilled its object. Mr. Loftus Wigram is the new principal.

WE have received as an excerpt from vol. iv. of the "Scientific Results of the Scottish National Antarctic Expedition" a report on the *Scotia* collection of Atlantic fishes by Mr. R. S. Clark. The fishes were collected between 40° N. and 36° S., near Azores, Madeira, Cape Verde Islands, Ascension, St. Helena, Cape Colony, St. Paul's Rocks, and their main interest is in increasing our knowledge of the geographical distribution of some species, *e.g.* at St. Helena. No new forms were found.

IN the January number of the Transactions of the Herts Natural History Society, Mr. J. Hopkinson gives a summary of the climate of Hertfordshire, based on general observations for twenty-five, and rainfall records for seventy, years. February, March, and April are the driest, and the months from July to November the wettest, October attaining the maximum in the latter respect. The minimum rainfall in any year at any one station during the period under review was 15·79, and the maximum 42·56 in.

BOTH the January and February numbers of *My Children's Magazine,* edited by Mr. Mee, contain admirable and well-illustrated natural history articles specially suited to juvenile readers. The subject in the January issue relates to insects serviceable to man; particular attention being directed to the collection and preparation of silk-cocoons in Syria. Reference is also made to a scarcity of flowers in the south of England, owing to the ravages of the bee-disease. The food-storing habits of various animals form the subject of the article in the February issue.

TO vol. xxv., part 2, of the Bulletin of the American Museum of Natural History, Dr. R. Broom contributes an illustrated catalogue of type and figured specimens of Permian, Triassic, and Jurassic South African reptiles in the collection, as an instalment of the catalogue of the whole series of typical and figured fossil vertebrates in the museum. The South African collection, which is a particularly fine one, was mainly brought together by Dr. Broom himself. The publication is dated January, 1915, but it unfortunately contains the description of a new genus and species (*Youngina gracilis*) which had already been named in the fourth part of the Zoological Society's Proceedings for 1914, published in December last.

SOME fundamental morphological objections to the mutation-theory of de Vries, by Prof. E. C. Jeffrey, and the English black-and-white rabbit in connection with the question of Mendelian unit-character constancy, by Messrs. W. E. Castle and P. B. Hadley, form the subjects of two out of the three chief articles in the January number of the *American Naturalist.* In the former it is asserted that *Oenothera lamarckiana,* and other species of the same genus, which form the main basis of the de Vriesian mutation hypothesis, are (like other members of the Onograceæ) much contaminated by natural hybridism. The species of Œnothera are thus largely, if not wholly, cryptohybrids; and Bateson's objection to the genetical purity of *Oe. lamarckiana* is confirmed and also shown to be applicable to other members of the group. As hybridism is the best explanation of the behaviour of these species in cultures, it follows that the de Vriesian hypothesis, "so far as it is supported by the case of *Oe. lamarckiana,* is invalid."

IN an article on eugenics and the war, in the January number of the *Eugenic Review,* Mr. Theodore Chambers emphasises the all-importance in warfare of supreme care and attention in the treatment of the sick and wounded. In the old days, at any rate, the vastly greater proportion of the deaths in war were due to sickness; and although matters have immensely improved in this respect, "it is necessary to urge that even to-day far too little attention is being given by the nations which consider themselves the most civilised in the world to this aspect of war." Later on he observes that "from a military point of view, a voluntary army is probably far more efficient for its numbers than a conscript one. . . . One willing fighter is worth six pressed men." It is added that as universal training without conscription would raise the general physique of the nation, and in war-time would vastly increase the number of recruits for voluntary service, it is probable "that the best combination from the military and eugenic standpoints would be universal training with voluntary service for war."

THE Yale Peruvian Expedition has added a further contribution to our knowledge of Peru in the publication of an account of the Liverworts, by Dr. A. W. Evans, in the Transactions of the Connecticut Academy of Arts and Sciences, vol. xviii., of April, 1914. Many of the species come from the High Andes around Cuzco, and some from the forests of the eastern slopes. Of the thirty-one species collected, six were previously unknown. The paper contains good illustrations and useful notes on the geographical distribution of the several species, a small number of which are peculiar to the Andes.

A COMPREHENSIVE account of Sea Island cotton in the West Indies, recently issued by the Imperial Department of Agriculture as Pamphlet No. 74, forms a very trustworthy guide to those concerned in the West Indian cotton industry. The history of the industry is detailed, and chapters follow on the botany, cultivation, picking, and grading, examination of seed cotton and lint, insect pests, and diseases, etc. The pamphlet consists of 118 pages, and is very well illustrated, the general information has been selected with great care, and the compilers are to be congratulated on the preparation of so useful a manual.

THE story of the discovery of the fine cycad, *Encephalaitos Hildebrandtii* by Sir John Kirk, in Zanzibar and East Africa, and the transmission of specimens to Kew between the years 1868–78, forms an interesting contribution to Kew Bulletin No. 10, 1914. The story is told in extracts from Sir John Kirk's correspondence with Kew while he was acting as Consul-General at Zanzibar. Sir John's observations on the remarkable generation of heat in the male cones, made in 1878, are published for the first time; on one occasion a rise of temperature of as much as 16·5° F. was recorded.

THE compensation payable to tenant farmers for unexhausted manurial residues is mainly based on the tables drawn up by Hall and Voelcker with a view to their general application to stock of all kinds. It has been suggested by some valuers that special discrimination should be made in the case of pigs, on the grounds that the feeding of the pig differs greatly from that of other stock, and is largely restricted to the intensive feeding of young animals during the period of most rapid growth. In proportion to its weight the pig eats more dry matter and voids less dung than any other class of farm animal, so that a relatively high compensation value must be made for a relatively small weight of manure. In the current number of the *Journal of the Board of Agriculture,* Prof. Charles Crowther and Mr. A. G. Ruston describe an experiment designed to throw more light on this point. Two groups of pigs were confined in special pens, without litter, for periods of five days in each fortnight of the twenty-three weeks that the experiment lasted. All food consumed during the five days was weighed and sampled for analysis, but the excreta were collected only on the last three days of each period. There was a remarkably close agreement between the figures given by the two groups of animals, which showed an average weekly gain of 6¼ lb. per pig over the whole period of the experiment. The authors conclude that the manurial residues should not be credited with more than 25 per cent. of the nitrogen, 50 per cent. of the phosphoric acid, and 80 per cent. of the potash present in the foods. This means that the compensation allowance in the special case considered should be assessed at only three-fifths of that deduced from Hall and Voelcker's tables.

MR. E. H. CUNNINGHAM CRAIG, in a paper read before the Institution of Petroleum Technologists, has given a brief account of the prospective oilfields of Western Canada. This paper should be a welcome one as authoritative information upon the subject of these supposed oil regions is but scarce, although a number of wild rumours about one or other of them have been current for the last year or two. Unfortunately, Mr. Craig gives no very large amount of geological detail—probably there is not yet a great deal known definitely—but he shows that practically all the oil hitherto discovered in Western Canada comes from the Cretaceous formation, which is well, though irregularly, developed over a very large tract of country. He deals with three main areas, the Flathead and Pincher fields, the Calgary field, and the Vancouver area; the greater part of his paper is devoted to the second of these, which he appears to regard as decidedly promising, and he gives a full account of the wells that have so far yielded oil. Amongst these he describes the Discovery or Dingman well of the Calgary Petroleum Products Co., which has yielded an extraordinary water-clear oil, containing no less than 72 per cent. of benzine and capable of being used crude in the engine of a motor-car. It is evidently too early for any definite opinion to be pronounced as to the possibilities of Western Canada as a producer of petroleum, but Mr. Craig, who has studied the whole area very thoroughly, appears to be very hopeful as to its possibilities.

THE war and the weather during the first three months of the fighting is dealt with in the *Popular Science Monthly* for December by Prof R. deC. Ward, of Harvard University. The author points out the weather influence on war as one of the great controls to be reckoned with by every commander, and he likens the disregard of the weather factor to be about as serious as to forget to provide food, clothing, or ammunition. Some historical instances are given of the influence of weather on war. Mention is made of the weather controls being divided into two classes. In one the conditions are accidental, sudden, or unexpected, and in the other case the conditions are natural or normal, but not necessarily prepared for. The author says to know in advance the general climate of the war zone is very essential in planning a campaign or in organising a single engagement. From the nature of the despatches, he concludes that there was nothing in the meteorological conditions in August and in early September which had any noticeable effect upon the campaign. In mid-September constant reference was made to the difficulties caused by the heavy rains. The normal rains in September and October filled the trenches and often drove the troops out to fight with their bayonets, and the difficulty of moving heavy guns through the deep mud was a serious handicap to both armies, whilst the rivers were also flooded. The roads became quagmires, and in Galicia the soldiers were marching and camping in the snow. With the use of aeroplanes and airships modern warfare has been rendered more than ever dependent on the weather.

The Central for December, 1914, states that 174 former students or members of the staff of the City and Guilds College, Exhibition Road, South Kensington, are now on active service. The positions held by some of these are mentioned in the nine pages devoted to old students and their doings, which always forms one of the most noticeable and, to most readers, welcome features of the magazine. A well-illustrated article of exceptional interest is that by Mr. A. C. Cookson describing the work which falls to the lot of the maintenance department of a railway.

PART I. of the new volume of the Proceedings of the Physical Society of London extends to 117 pages. The president, Sir J. J. Thomson, opens the volume with the account he gave at the Cambridge meeting of the society of his attempts to produce radiations to fill the gap of about eight octaves between the softest Röntgen radiation and the shortest ultra-violet rays. His address as president closes the issue. It deals with the production and nature of the ions in gases. At the present time the interaction between ions and molecules appears to be explainable either by Maxwell's inverse fifth power law or by the law of impacts of hard spheres. Two papers are devoted to electrical questions—Mr. D. Owen's on an alternating-current bridge method of determining inductance in terms of resistance and capacity; and Mr. A. F. Hallimond's on the voltage ampere curves given by a great number of point contacts when the voltage applied to the contacts is gradually raised. The only paper on heat is Mr. Barratt's on the heat conductivities of a number of glasses, woods, and other bad conductors. Two papers deal with general physics. Mr. B. W. Clack gives the final results of his work on the diffusivities of salts in dilute solutions, and Prof. E. P. Harrison traces the effect of temperature on Young's modulus for wires.

IN the *Revue générale des Sciences* (vol. xxv., p. 777) M. Louis Brunet discusses the position of the combatant nations as regards the power of obtaining supplies of the metals copper, zinc, lead, tin, nickel, and mercury, which play so important a part in modern warfare. The conclusion reached is that the position of the Franco-Anglo-Russian alliance is far better than that of the central European empires, not so much on account of the greater producing power of the alliance, but owing to its mastery of the sea, which has enabled the English and French fleets to prevent in large measure the importation of metals declared "contraband of war" from neutral countries into Germany and Austria.

THE *Times* Engineering Supplement of January 29 gives an interesting account of aeronautics in 1914. Among other notable achievements of the past year are the British record of 135 miles an hour, heights of five miles scaled, or closely approached, by both French and German machines, and flights in seventy miles-per-hour winds by fliers who do not pretend to be "star-pilots." No fewer than nineteen persons flew together in one huge aeroplane of Russian make in 1914. One of our own Army-built stable aeroplanes has climbed at the rate of 1700 ft. a minute—a rate of ascent four times as fast as an express lift in an American hotel. Eight months ago Dr. Glazebrook gave, before the Aeronautical Society, a *résumé* of the experiments which had achieved stability—experiments vouched for by Colonel Seely, who verified them by making uncontrolled flights in person without any previous practice. Though Bryan and Harper had published their mathematical work in 1911, and Lanchester three years before that, it was only these telling practical outcomes of their work that brought these authors into their own in England during the past year.

OUR ASTRONOMICAL COLUMN.

WOLF-RAYET STARS AND THE PLANETARY NEBULÆ.—There are indications that these enigmatic bodies will shortly be fitted into the scheme of stellar evolution. Hitherto, whilst it was felt that they must be more or less related, actual evidence was of the slenderest. Prof. J. W. Nicholson was, however, led by his mathematical investigations of the spectra of *nebulium* and Wolf-Rayet stars to suggest that they were successive stages in the evolution of matter. Perhaps we can now say that this is an observed fact. The *Astrophysical Journal* for December (1914) contains some remarkable preliminary results obtained by Mr. W. H. Wright in the course of the spectroscopic examination of some planetary nebulæ possessing central condensations. A spectrogram secured with the 36-inch refractor (Lick), under exceptionally close following during a long exposure on N.G.C. 6572, showed *the spectrum of the nucleus* crossed by the bright nebular lines of the envelopes, and, moreover, in the spectrum of the nucleus appeared a band 17 Å. wide in place of the line λ 4686. These facts recalled the hitherto unique hydrogen envelope star of Campbell (BD + 30° 3639). Detailed study of the spectrum of this body was then undertaken and, as was expected, the fact was established that the hydrogen envelope really gave the spectrum of a planetary nebula.

Here, then, are two cases of planetary nebulæ having nuclei which exhibit the spectra of Wolf-Rayet stars and, together with three other cases (N.G.C. 6826, N.G.C. Index 418, and N.G.C. 40) cited from unpublished observations by Merrill, Campbell, and Paddock respectively, the facts are held to justify the conclusion that such nuclei are in *all cases* Wolf-Rayet stars. The evidence does *not* establish the converse proposition that Wolf-Rayet stars are in all cases the nuclei of planetary nebulæ The author promises a more detailed account of the observations and also the early publication of a list of nebular lines. The materialisation of these promises will be eagerly anticipated

THE SOLAR ROTATION IN 1913.—In the current number of the Journal of the Royal Astronomical Society of Canada (September-October, 1914) Mr. H. H. Plaskett gives an account of the results of a study of the solar rotation which he and Mr. R. E. De Lury secured during 1913. The method was spectroscopic, and the region of the spectrum examined was λ 5600; thirty-one plates were utilised, on each of which were recorded nine rotation spectra; in these spectra displacements were measured for twelve lines. Tables summarise the measures and the results. The results are compared with those obtained for the same region of the spectrum in the years 1911 and 1912 by Messrs.